Application No.09/746,744
Filed: December 22, 2000
TC Art Unit: 2666
Confirmation No.: 6878

REMARKS

In response to an Office Action mailed on January 13, 2006, Applicant respectfully requests that the above-listed Amendments be entered and the Application be reconsidered in light of the following remarks. With entry of the above-listed Amendments, claims 1, 12, 25, 28 and 39 are amended; no claims are canceled; and no claims are new. Thus, 44 claims are presented for examination. Of these, claims 1, 12, 25, 28 and 39 are independent, and the remaining claims are dependent.

The Examiner rejected claims 1-44 under 35 U.S.C. 102(e) as being anticipated by US Pat. No. 6,611,519 to Howe ("Howe"). The Application discloses and claims apparatus and methods for schedule-based switching of data packet flows. The disclosed apparatus and methods operate at layer 2 or higher in the seven layer Open System Interconnect (OSI) model. Howe's system clearly operates at only layer 1 of the OSI model. Furthermore, Howe teaches away from operating above layer 1. All the independent claims have been amended to recite layer 2 processing. Each of these points is discussed in more detail below.

The OSI model defines a networking framework for implementing protocols in seven layers. Control is passed from one layer to the next, starting at the application layer (layer 7) in one station, proceeding to the bottom layer (layer 1), over a channel to the next station and back up the hierarchy. (http://www.cisco.com/univercd/cc/td/doc/cisintwk/ito_doc/introint.htm#xtocid5.) Layer 1 is the physical layer of the OSI model. Layer 1 provides a hardware means of sending and receiving data on a carrier, including defining cables, circuit cards and physical aspects of connectors. Layer 1 components convey bit streams, i.e., electrical impulses, light or radio signals, through a medium between physical devices. Layer 1 components have no understanding of packets or frames. At layer 1, data consists of analog signals that are not framed or grouped into packets.

On the other hand, layer 2 is used to transfer frames (containing packets) between or among layer 2 logical devices using a layer 2 protocol, such as Ethernet, SONET or SDH. Such logical devices may be, for example, ports of a switch. The logical devices have their own layer 2 addresses. A frame includes a "next-hop" address, i.e., an address of the next layer 2 logical device along a path from the sending station to the receiving station. Thus, when a frame is received on one port of a switch that uses the same layer 2 protocol on all its ports, the next-hop address in the frame

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header must be changed, so the frame can be forwarded across the next transmission link to the next logical device along the path. Howe's switch operates at layer 1, thus Howe's switch is incapable of manipulating frame headers.

A router is a switching device that terminates connections from two or more networks. The networks may use different layer 2 protocols. In this case, when a packet is switched between networks that have incompatible layer 2 types, the frame header must be replaced. For example, a router cannot transmit an Ethernet frame over a SONET link, because SONET transmission logic cannot process the Ethernet frame.

Layer 2 components also deal with frame synchronization, flow control and error checking. Thus, layer 2 processing is significantly different than layer 1 processing, at least because layer 2 processing involves frames and packets, whereas layer 1 processing involves bit streams.

The disclosed and claimed invention processes packets. For example, in one embodiment, RISC engines 403, 404, 405, 406, etc. extract packet data from framing data and determine packet destinations. (Application: page 33, 1st full paragraph and 2d full paragraph.) Recognizing frame and packet boundaries, as needed to perform such extraction and destination determination, requires layer 2 processing logic.

Another embodiment receives packets (as bit streams), into physical layer devices 302. (Application: page 34, 2d full paragraph; Fig. 8.) These physical layer devices 302 convert signal levels, impedance and media to signals that can be interfaced to network processors 303, 304, etc. The network processors 303, 304, etc. perform higher-layer functions. For example, as each new packet is received by the switch, the network processors 303, 304, etc. determine if a schedule is in effect and, if so, forward the packet to a switching fabric. Thus, the network processors 303, 304, etc. must be aware of the beginning and end of the packet. Consequently, the network processors 303, 304, etc. must operate at layer 2 or above, because there is no notion of packets at layer 1.

Each of the independent claims recites a packet limitation. For example, claim 1 recites, "receiving expected packet arrival time information...," "receiving a packet..." and "forwarding ... said packet..." (Emphasis added.) In addition, all the independent claims, i.e., claims 1, 12, 25, 28 and 39, have been amended to recite a layer 2 limitation. For example, method claim 1 has been amended to recite, "performing at least some layer 2 processing on said packet."

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Operating at layer 2 or above provides advantages over operating at only layer 1. For example, error checking can be performed to determine if a received packet is a valid layer 2 packet. Invalid packets can be dropped. Such error detection is not possible at layer 1.

In contrast to the disclosed and claimed invention, Howe discloses a master clock, synchronized clocks in a plurality of network elements and a switch that operates at only layer 1. (*See*, Title; Abstract; col. 4, lines 8-42.) Howe's switch operates to "bypass[] the entire network at a layer one or physical level at the correct scheduled time." (Emphasis added.)

Howe asserts that operating at layer 1 is superior to operating at higher layers. For example, Howe asserts that higher layer (i.e., layer 2-4) processing of packets causes real-time applications to suffer quality and time delays. (Col. 2, lines 29-34 and 47-49.)

Furthermore, during prosecution of the Howe patent, Howe distinguished his claims from a prior art reference (US Pat. No. 5,805,589, "Hochschild") by arguing that the prior art discloses packet switching at layer 2 or above, but the prior art does not disclose, teach, or suggest processing at layer 1. Howe argued that certain limitations in his independent claims, such as a "layer one connection," "opening ... a layer one connection at a time in accordance with said reservation schedule," and "transmitting information ... through said layer one connection," distinguish his invention from the prior art. (Howe Amendment in response to October 4, 2002 Office Action; emphasis in original.)

Thus, Howe clearly teaches away from a switch that operates at layer 2 or above. Furthermore, opening a layer 1 connection is structurally different than forwarding packets, as recited in claim 1. Opening a layer 1 connection passes a bit stream, which may not necessarily constitute frames or packets. For example, the bit stream may be simply an unorganized stream of bits that are not formatted in frames or packets. In contrast, the claimed invention forwards packets. Consequently, the claimed invention would not forward an unorganized bit stream, which, as noted above, provides an advantage over Howe's teachings.

No art of record, either alone or in combination, discloses or suggests a method for switching data packet flows with guaranteed delay and bandwidth that includes "performing at least some layer 2 processing on said packet," as recited in amended claim 1. For at least this reason, claim 1 is believed to be allowable.

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Independent claims 12, 25, 28 and 39 have also been amended to include layer 2 limitations. These claims are believed to be allowable, for at least the reasons given above, with respect to claim 1.

All the dependent claims depend directly or indirectly from independent claim 1, 12, 25, 28 or 39. All the dependent claims are, therefore, believed to be allowable, for at least the reasons give above, with respect to claim 1.

For all the foregoing reasons, it is respectfully submitted that the present Application is in a condition for allowance, and such action is earnestly solicited. The Examiner is encouraged to telephone the undersigned attorney to discuss any matter that would expedite allowance of the present Application.

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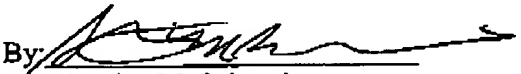
Respectfully submitted,

STEVEN A. ROGERS

By: 

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